C440/XTOE Electronic Overload Relay, PROFIBUS

User Manual

Effective March 2011
New Information

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Safety

Definitions and Symbols

WARNING

This symbol indicates high voltage. It calls your attention to items or operations that could be dangerous to you and other persons operating this equipment. Read the message and follow the instructions carefully.

This symbol is the "Safety Alert Symbol." It occurs with either of two signal words: CAUTION or WARNING, as described below.

WARNING

Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage to the product. The situation described in the CAUTION may, if not avoided, lead to serious results. Important safety measures are described in CAUTION (as well as WARNING).

Hazardous High Voltage

WARNING

Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, there may be exposed components with housings or protrusions at or above line potential. Extreme care should be taken to protect against shock.

Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case an emergency occurs. Disconnect power before checking controllers or performing maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on electronic controllers or rotating machinery.

Warnings and Cautions

WARNING

Do not service with voltage applied—Lock-out Tags.

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Introduction

System Overview

Eaton's new electronic overload relay (EOL) is the most compact, high-featured, economical product in its class. Designed on a global platform, the new EOL covers the entire power control spectrum including NEMA®, IEC, and DP contactors. The NEMA and DP versions are offered with the *C440* designation while the IEC offering has the ***XT*** designation. The electronic design provides reliable, accurate and value driven protection and communications capabilities in a single compact device. It is the flexible choice for any application requiring easy-to-use, reliable protection.

Eaton has a long history of innovations and product development in motor control and protection, including both traditional NEMA, as well as IEC control. It was from this experience that the C440 was developed, delivering new solutions to meet today's demands.

C440 is a self-powered electronic overload relay available up to 100A as a self contained unit. With external CTs, C440 can protect motor up to 1500 FLA. Available add-on accessories include remote reset capability and communication modules with I/O for DeviceNet™, PROFIBUS®, and Modbus®.

Features and Benefits

Features

- Reliable, accurate, electronic motor protection
- Easy to select, install and maintain
- Compact size
- Flexible, intelligent design
- Global product offering—available with NEMA, IEC, and DP power control

Size/Range

- Broad FLA range (0.33–1500A)
- Selectable trip class (10A, 10, 20, 30)
- Direct mounting to NEMA, IEC, and DP contactors
- Most compact electronic overload in its class

Motor Control

- Two B600 alarm (NO) and fault (NC) contacts
- Test/Trip button

Motor Protection

- Thermal overload
- Phase loss
- Selectable (ON/OFF) phase unbalance
- Selectable (ON/OFF) ground fault

User Interface

- Large FLA selection dial
- Trip status indicator
- Operating mode LED
- DIP switch selectable trip class, phase unbalance, and ground fault
- Selectable Auto/Manual reset

Feature Options

- Remote reset
  - 120 Vac
  - 24 Vac
  - 24 Vdc
- Tamper-proof cover
- Communications modules
  - Modbus RTU RS-485
  - DeviceNet with I/O
  - PROFIBUS with I/O
  - Modbus RTU with I/O (Q4 2010)
  - Ethernet IP (planned)

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Benefits

Reliability and Improved Uptime

- C440 provides the users with peace of mind knowing that their assets are protected with the highest level of motor protection and communication capability in its class
- Extends the life of plant assets with selectable motor protection features such as trip class, phase unbalance, and ground fault
- Protects against unnecessary downtime by discovering changes in your system (line/load) with remote monitoring capabilities
- Status LED provides added assurance that valuable assets are protected by indicating the overload operational status

Flexibility

- Available with NEMA, IEC and DP contactors
- Improves return on investment by reducing inventory carrying costs with wide FLA adjustment (5:1) and selectable trip class
- Design incorporates built-in ground fault protection thus eliminating the need for separate CTs and modules
- Flexible communication with optional I/O enables easy integration into plant management systems for remote monitoring and control
- Available as an open component and in enclosed control and motor control center assemblies

Monitoring Capabilities

- Individual phase currents rms
- Average three-phase current rms
- Thermal memory
- Fault indication (overload, phase loss, phase unbalance, ground fault)

Safety

- IP 20 rated terminal blocks
- Available in Eaton's industry leading FlashGard MCCs
- Tested to the highest industry standards such as UL, CSA, CE, and IEC
- RoHS compliant

Standards and Certifications

- UL®
- CSA®
- CE
- NEMA
- IEC/EN 60947 VDE 0660
- ISO® 13849-1 (EN954-1)
- RoHS
- ATEX directive 94/9/EC
- Equipment Group 2, Category 2

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Electronic Overload Education

Description	Definition	Cause	Effect if Not Protected	C440/*XT* Protection
Motor Protection				
Thermal overload	Overload is a condition in which current draw exceeds 115% of the full load amperage rating for an inductive motor.	• An increase in the load or torque that is being driven by the motor • A low voltage supply to the motor causes the current to go high to maintain the power needed • A poor power factor causing above normal current draw	• Increase in current draw leads to heat and insulation breakdown, which can cause system failure • Increase in current can increase power consumption and waste valuable energy	• Thermal trip behavior is defined by UL, CSA, and IEC standards • Trip class is settable from 10A, 10, 20, 30
Ground fault	A line to ground fault.	A current leakage path to ground.	An undetected ground fault can burn through multiple insulation windings, ultimately leading to motor failure, not to mention risk to equipment or personnel	Fixed protective setting that takes the starter offline if ground fault current exceeds 50% of the FLA dial setting, for example, if the FLA dial is set to 12A, the overload relay will trip if the ground current exceeds 6A.
Unbalanced phases (voltage and current)	Uneven voltage or current between phases in a three-phase system.	When a three-phase load is powered with a poor quality line, the voltage per phase may be unbalanced.	Unbalanced voltage causes large unbalanced currents and as a result this can lead to motor stator windings being overloaded, causing excessive heating, reduced motor efficiency and reduced insulation life.	Fixed protective setting that takes the starter offline if a phase drops below 50% of the other two phases.
Phase loss—current (single-phasing)	One of the three-phase voltages is not present.	Multiple causes, loose wire, improper wiring, grounded phase, open fuse, and so on.	Single-phasing can lead to unwanted motor vibrations in addition to the results of unbalanced phases as listed above.	Fixed protective setting that takes the starter offline if a phase drops below 50% of the other two phases.

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Technical Data and Specifications

Electronic Overload Relay Ratings

Electronic Overload Relays Up to 1500A—Ratings and Specifications

Description	Specification 45 mm	55 mm
Electrical Ratings	**Range**	**Range**
Operating voltage (three-phase) and frequency	690 Vac (60/50 Hz)	690 Vac (60/50 Hz)
FLA Range		
	0.33–1.65A; 1–5A; 4–20A; 9–45A	20–100A
Use with Contactors		
XT IEC frames	B, C, D	F, G
Freedom NEMA sizes	00, 0, 1, 2	3
Trip Class		
	10A, 10, 20, 30; selectable	10A, 10, 20, 30; selectable
Motor Protection		
Thermal overload setting	1.05 x FLA: does not trip 1.15 x FLA: overload trip	1.05 x FLA: does not trip 1.15 x FLA: overload trip
Feature	**Range**	**Range**
Phase loss	Fixed threshold 50%	Fixed threshold 50%
Phase unbalance (selectable: enable/disable)	Fixed threshold 50%	Fixed threshold 50%
Ground fault (selectable: enable/disable)	50% of FLA dial setting >150% = 2 sec >250% = 1 sec	50% of FLA dial setting >150% = 2 sec >250% = 1 sec
Reset	Manual/automatic	Manual/automatic
Indicators		
Trip status	Orange flag	Orange flag
Mode LED	One flash: Overload operating properly Two flashes: Current is above FLA dial setting—pending trip	One flash: Overload operating properly Two flashes: Current is above FLA dial setting—pending trip
Options		
Remote reset	Yes	Yes
Reset bar	Yes	Yes
Communication expansion module	Yes	Yes
Communication adapter	Yes	Yes
Capacity		
Load terminals		
Terminal capacity	12–10 AWG (4–6 mm^2) 8–6 AWG (6–16 mm^2)	6–1 AWG (16–50 mm^2)
Tightening torque	20–25 lb-in (2.3–2.8 Nm) 25–30 lb-in (2.8–3.4 Nm)	25–30 lb-in (2.8–3.4 Nm)
Input, auxiliary contact and remote reset terminals		
Terminal capacity	2 x (18–12) AWG	2 x (18–12) AWG
Tightening torque	5.3 lb-in (0.8–1.2 Nm)	5.3 lb-in (0.8–1.2 Nm)

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Electronic Overload Relays Up to 1500A—Ratings and Specifications, continued

Description	Specification 45 mm	55 mm
Voltages		
Insulation voltage U_i (three-phase)	690 Vac	690 Vac
Insulation voltage U_i (control)	500 Vac	500 Vac
Rated impulse withstand voltage	6000 Vac	6000 Vac
Overvoltage category/pollution degree	III/3	III/3
Auxiliary and Control Circuit Ratings		
Conventional thermal continuous current	5A	5A
Rated operational current—IEC AC-15		
Make contact (1800 VA)		
120V	15A	15A
240V	15A	15A
415V	0.5A	0.5A
500V	0.5A	0.5A
Break contact (180 VA)		
120V	1.5A	1.5A
240V	1.5A	1.5A
415V	0.9A	0.9A
500V	0.8A	0.8A
IEC DC-13 (L/R F 15 ms1)		
0–250V	1.0A	1.0A
Rated operational current—UL B600		
Make contact (3600 VA)		
120V	30A	30A
240V	15A	15A
480V	7.5A	7.5A
600V	6A	6A
Break contact (360 VA)		
120V	3A	3A
240V	1.5A	1.5A
480V	0.75A	0.75A
600V	0.6A	0.6A
R300— Vdc ratings (28 VA)		
0–120V	0.22A	0.22A
250V	0.11A	0.11A

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Electronic Overload Relays Up to 1500A—Ratings and Specifications, continued

Description	Specification 45 mm	55 mm
Short-Circuit Rating without Welding		
Maximum fuse	6A gG/gL	6A gG/gL
Environmental Ratings		
Ambient temperature (operating)	–13° to 149°F (–25° to 65°C)	–13° to 149°F (–25° to 65°C)
Ambient temperature (storage)	–40° to 185°F (–40° to 85°C)	–40° to 185°F (–40° to 85°C)
Operating humidity UL 991 (H3)	5% to 95% non-condensing	5% to 95% non-condensing
Altitude (no derating) NEMA ICS1	2000m	2000m
Shock (IEC 600068-2-27)	15g any direction	15g any direction
Vibration (IEC 60068-2-6)	3g any direction	3g any direction
Pollution degree per IEC 60947-4-1	3 for product (2 for pcb)	3 for product (2 for pcb)
Ingress protection	IP20	IP20
Protection against direct contact when actuated from front (IEC 536)	Finger- and back-of-hand proof	Finger- and back-of-hand proof
Mounting position	Any	Any
Climatic proofing	Damp heat, constant to IEC 60068-2-30	Damp heat, constant to IEC 60068-2-30
Electrical/EMC		
Radiated emissions IEC 60947-4-1-Table 15 EN 55011 (CISPIR 11) Group 1, Class A, ISM	30 MHz to 1000 MHz	30 MHz to 1000 MHz
Conducted emissions IEC 60947-4-1-Table 14 EN 55011 (CISPIR 11) Group 1; Class ISM	0.15 MHz to 30 MHz	0.15 MHz to 30 MHz
ESD immunity IEC 60947-4-1 (Table 13)	±8 kV air, ±6 kV contact	±8 kV air, ±6 kV contact
Radiated immunity IEC 60947-4-1 IEC 61000-4-3	10V/m 80 MHz–1000 MHz 3V/m from 1.4 to 2.7 gHz 80% amplitude modulated 1 kHz sine wave	10V/m 80 MHz–1000 MHz 3V/m from 1.4 to 2.7 gHz 80% amplitude modulated 1 kHz sine wave
Conducted immunity IEC 60947-4-1, IEC 61000-4-6	140 dub (10V rms) 150 kHz–100 MHz	140 dub (10V rms) 150 kHz–100 MHz
Fast transient immunity IEC 60947-4-1 (Table 13) IEC 61000-4-4	±4 kV using direct method with accessory installed in expansion bay ±2 kV using direct method	±4 kV using direct method with accessory installed in expansion bay ±2 kV using direct method

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Electronic Overload Relays Up to 1500A—Ratings and Specifications, continued

Description	Specification 45 mm	55 mm
Electrical/EMC, continued		
Surge immunity IEC 60947-4-1 (Table 13) IEC 61000-4-5 a Class 4	Three-phase power inputs: ±4 kV line-to-line (DM) ±4 kV line-to-ground (CM)	Three-phase power inputs: ±4 kV line-to-line (DM) ±4 kV line-to-ground (CM)
	With accessory installed in expansion bay: ±2 kV line-to-line (DM) –>1.2/50 us; 2 kV line-to-earth, 1 kV line-to-line ±4 kV line-to-ground (CM)	With accessory installed in expansion bay: ±2 kV line-to-line (DM) –>1.2/50 us; 2 kV line-to-earth, 1 kV line-to-line ±4 kV line-to-ground (CM)
Power freq. magnetic field immunity IEC 60947-4-1, IEC 61000-4-8	30A/m, 50 Hz	30A/m, 50 Hz
Electromagnetic field IEC 60947-4-1 Table 13, IEC 61000-4-3	10V/m	10V/m
Distortion IEEE 519	5% THD max., 5th harmonic 3% max.	5% THD max., 5th harmonic 3% max.
Electrostatic discharge (ESD) IEC 61000-4-2, EN 61131-2	4 kV contact 8 kV air discharge	4 kV contact 8 kV air discharge
Electrical fast transient (EFT) IEC 61000-4-4, EN 61131-2	±2 kV using direct method	±2 kV using direct method
Surge immunity IEC 61000-4-5, EN 61131-2	±2 kV line-to-ground (CM)	±2 kV line-to-ground (CM)

Short Circuit Ratings

Short Circuit Ratings (North America CSA, cUL)

Changes to UL 508A and NEC in recent years have brought a focus to control panel safety with regard to short-circuit current ratings (SCCR). Eaton's C440 electronic overload relays combined with ***XT*** series IEC and Freedom Series NEMA contactors provide a wide variety of SCCR solutions needed for a variety of applications. The SCCR data in this document reflects the latest information as of April 2010.

C440/*XT* Standalone Overload Relays (*XT*, C440)

		Standard-Fault Short Circuit Data			High-Fault Short Circuit Data					
					Fuses (RK5, J, CC)			Thermal-Magnetic Circuit Breakers		
Overload FLA Range	Maximum Operating Voltage	600V (kA)	Maximum Fuse Size (A) (RK5)	Maximum Breaker Size (A)	480V (kA)	600V (kA)	Maximum Fuse Size	480V (kA)	600V (kA)	Maximum Breaker Size
0.33–1.65A	600 Vac	1	6	15	—	—	—	—	—	—
1–5A	600 Vac	5	20	20	100	100	30	100	35	20
4–20A	600 Vac	5	80	80	100	100	100	100	35	80
9–45A	600 Vac	5	175	175	100	100	100	100	35	100/175 (480/600)
20–100A	600 Vac	10	400	400	100	100	200	150	35	250/400 (480/600)

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NEMA Freedom Series Starters with C440 Electronic Overload Relays

NEMA Size	Maximum Operating Voltage	High-Fault Short Circuit Data Fuse (RK5, J, CC) 480V	600V	Maximum Fuse Size	Thermal-Magnetic Circuit Breakers 480V	600V	Maximum Breaker Size
00	0.33–1.65A	100	100	30	—	—	—
	1–5A	100	100	30	100	35	35
	4–20A	100	100	30	100	35	35
0	0.33–1.65A	100	100	60	—	—	—
	1–5A	100	100	60	100	35	70
	4–20A	100	100	60	100	35	70
1	0.33–1.65A	100	100	100	—	—	—
	1–5A	100	100	100	100	35	100
	4–20A	100	100	100	100	35	100
	9–45A	100	100	100	100	35	100
2	1–5A	100	100	100	100	35	175
	4–20A	100	100	100	100	35	175
	9–45A	100	100	100	100	35	175
3	20–100A	100	100	200	50	50	250

IEC *XT* Starters with *XT* Electronic Overload Relays

NEMA Size	Maximum Operating Voltage	High-Fault Short Circuit Data Fuse (RK5, J, CC) 480V	600V	Maximum Fuse Size	Thermal-Magnetic Circuit Breakers 480V	600V	Maximum Breaker Size
B	1–5A	100	100	30	—	—	—
	4–20A	100	100	30	—	—	—
C	1–5A	100	100	60	—	—	—
	4–20A	100	100	60	—	—	—
	9–45A	100	100	60	—	—	—
D	9–45A	100	100	200	65	35	175
	20–100A	100	100	200	65	35	175
F	20–100A	100	100	200	65	65	350
G	20–100A	100	100	200	65	65	350

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Receipt/Unpacking

WARNING

Do not service with voltage applied—Lock-out Tags.

General

Upon receipt of the unit, verify that the catalog number and unit options stated on the shipping container match those stated on the order/purchase form.

Inspect the equipment upon delivery. Report any crate or carton damage to the carrier prior to accepting the delivery. Have this information noted on the freight bill. Eaton is not responsible for damage incurred in shipping.

Unpacking

Remove all packing material from the unit. Check the unit for any signs of shipping damage. If damage is found after unpacking, report it to the freight company. Retain the packaging materials for carrier to review.

Verify that the unit's catalog number and options match those stated on the order/purchase form.

Storage

It is recommended that the unit be stored in its original shipping box/crate until it is to be installed.

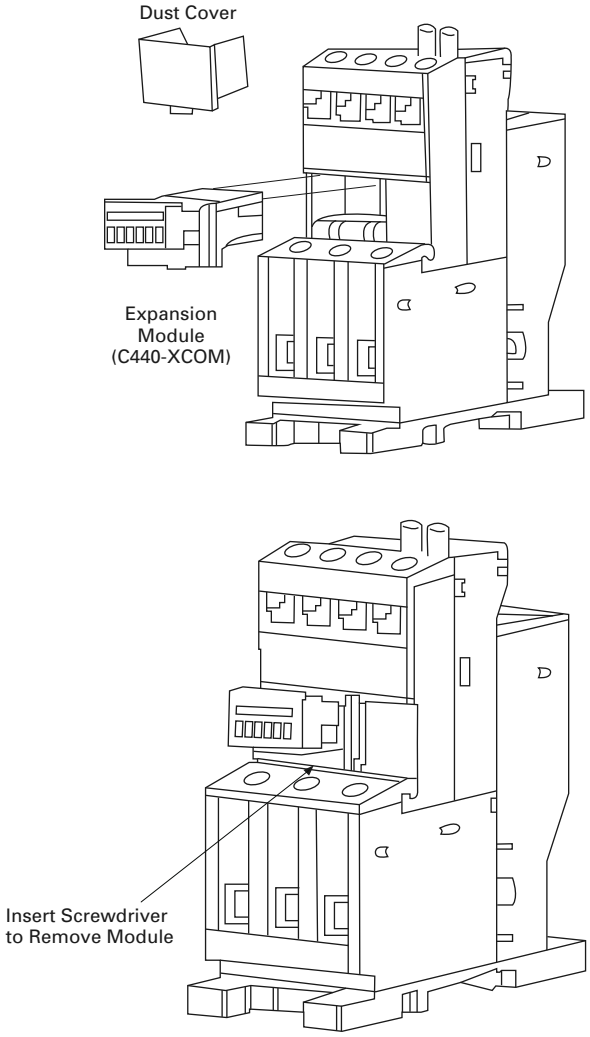
The unit should be stored in a location where:

- The ambient temperature is –40° to 85°C
- The relative humidity is 5–95%, non-condensing
- The environment is dry, clean and non-corrosive
- The unit will not be subjected to high shock or vibration conditions

Mounting

The expansion module (C440-XCOM) needs to be wired to the C440/XTOE electronic overload relay as shown in the figure below.

Expansion Module Wiring



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C441Q/S PROFIBUS Communication Module

Overview

The C441Q/S PROFIBUS communication modules are DPV0 slave devices used to connect various motor control/protection devices to a PROFIBUS network. The C441 PROFIBUS communication modules support the C441 MotorInsight Protective relay, the C440 Solid State Overload, and the S611 Softstarter. The C441 PROFIBUS communication modules allow the user to access setup parameters and I/O data of the attached base device over a PROFIBUS network.

The C441Q/S PROFIBUS communication modules will give the user the ability to:

- Configure the attached base device setup parameters over a PROFIBUS network
- Create custom I/O assemblies based upon their applications needs
- Exchange I/O between a master and slave over a PROFIBUS network
- Read out diagnostic information concerning the health of the attached base device

PROFIBUS Specifications

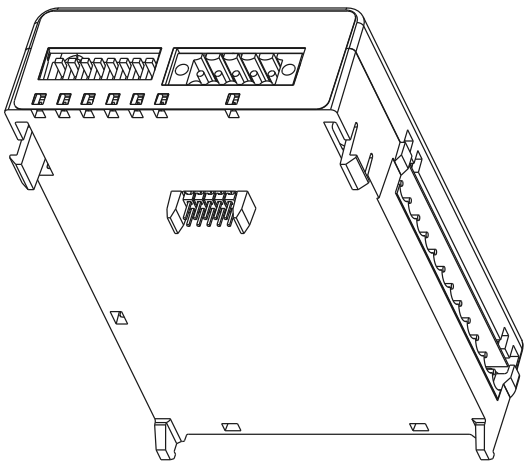
PROFIBUS Specifications

Description	Specification
PROFIBUS communications	DPV0
Vendor identification number	0x019D
PNO identification number	0x0C98
Maximum I/O modules	28
Maximum input data	100 bytes
Maximum output data	20 bytes
Maximum diagnostic message length	21 bytes
Supported PROFIBUS data rates	9.6k, 19.2k, 45.5k, 93.75k, 187.5k, 500k, 1.5M, 3M, 6M, 12M
Optional features	Freeze; Sync; and Fail-safe supported
GSD file	019D0C98.gsd@www.eaton.com

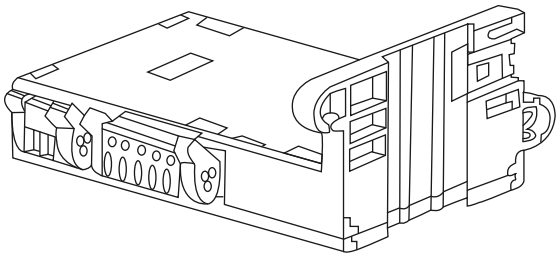
Mounting and Wiring

The C441Q/S PROFIBUS communication modules are designed to be connected to the C440 overload through the use of a C440-COM-ADP.

C441Q/S PROFIBUS Module



C440-COM-ADP



1. Connect the C441 PROFIBUS communication module to C440-COM-ADP by inserting the tabs located near the bottom of the C441Q/S PROFIBUS communication module into the lower slots on the C440-COM-ADP.
2. Pivot the C441 PROFIBUS communication module towards the C440-COM-ADP and gently snap the two together.
3. Wire the 24 Vdc supply to the 2-pin connector located on the C440-COM-ADP.

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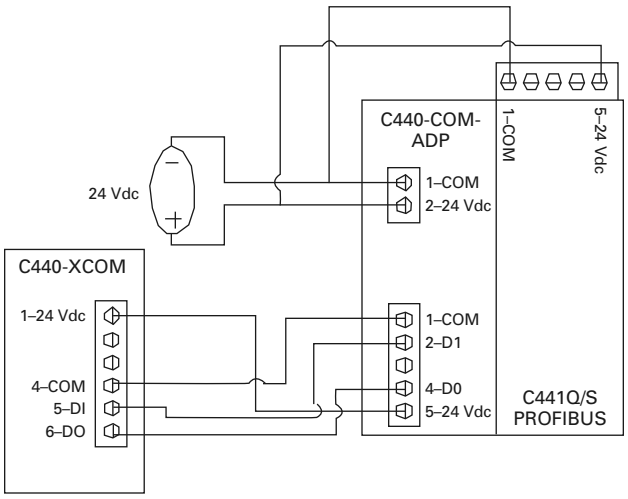
4. Wire the 24 Vdc supply to the 5-pin connector located on the top of the C441Q/S PROFIBUS communication module.
5. Wire the interconnection between the two communication ports. (See figure below.)

C440-XCOM		C440-COM-ADP
1–24 Vdc	to	5–24 Vdc
4–COM	to	1–COM
5–DI	to	2–D1
6–DO	to	4–DO

6. Wire any inputs and/or outputs that are to be connected to the C441Q/S PROFIBUS communication module. (See **Pages 16** and **17**.)
7. Connect the PROFIBUS cable to the DB9 connector located on the side of the C441Q/S PROFIBUS communication module.

C440-COM-ADP Wiring Diagram

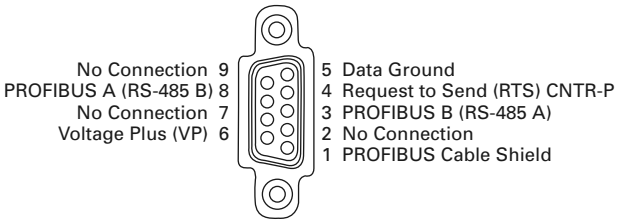


Connections

C441Q/S PROFIBUS Communication Module Connections

The PROFIBUS port uses the standard DB9 PROFIBUS connection. Refer to the figure below for details on the pin out of this connector.

Pin Out For PROFIBUS DB9



24 Vdc Power

The C441Q/S PROFIBUS communication module is powered from an external 24 Vdc supply wired into the 5-pin black header (J2) located on the top of the module next to the 8-position DIP switch.

24 Vdc Supply Connection

Pin No.	Circuit	Description
1	Common	24 Vdc common input connection
2	D1	N/A for PROFIBUS functionality
3	[?]	NC
4	D0	N/A for PROFIBUS functionality
5	+24 Vdc	24 Vdc supply input connection

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Quick Start

Install C441Q/S PROFIBUS Communication Module

1. Mount and connect the C441 PROFIBUS communication adapter to the C440 overload. (See **Page 11**.)
2. Connect the PROFIBUS network cable to the DB9 connector. (See **Page 11**.)
3. Connect 24 Vdc power to the 5-pin connector located on the top of the C441Q/S PROFIBUS communication module. (See **Page 11**.)
4. Set the DIP switches located on the top of the C441Q/S PROFIBUS communication module to the desired PROFIBUS slave address for the C441 module. (See **Page 15**.)

   Note: The PROFIBUS address is only updated during power-up.
5. Apply 24 Vdc power to the C441Q/S PROFIBUS communication module and C440 overload.

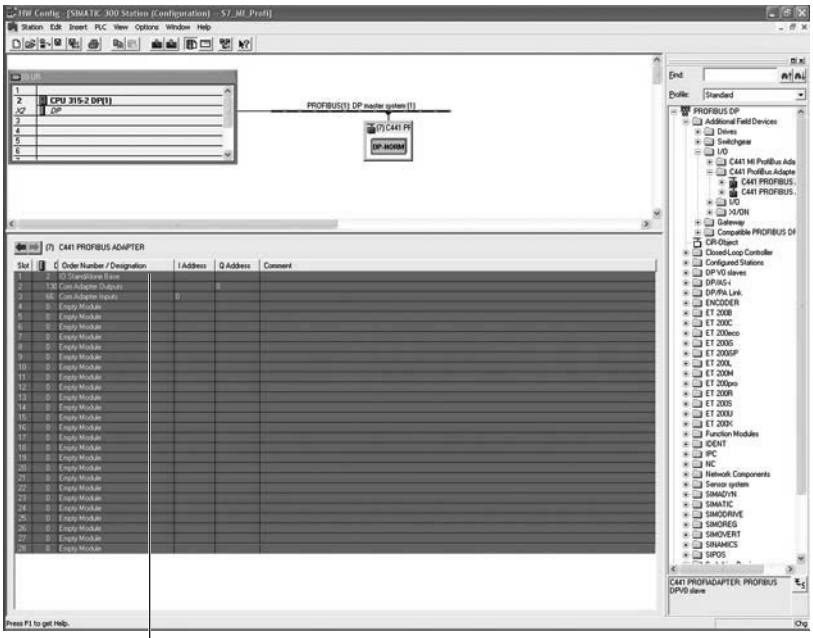
Configure C441Q/S PROFIBUS Communication Module

Note: The C441Q/S PROFIBUS communication module and the device parameters for the C440 overload can be configured through the Master's configuration tool.

Example: In Siemens®' Simatic Manager—The C441Q/S PROFIBUS communication module can be configured through the "HW Config" page.

1. Go to www.eaton.com and download the GSD file for the C441Q/S PROFIBUS module–019D0C98.gsd Rev 2.0.
2. In the Master's configuration tool, add the C441 PROFIBUS communication module to the network configuration.
3. The default configuration for the C441Q/S PROFIBUS communication module is a standalone I/O base. Remove the default modules from all 28 slots.

Remove Default Modules



Step 3: Remove the default modules from all 28 slots.

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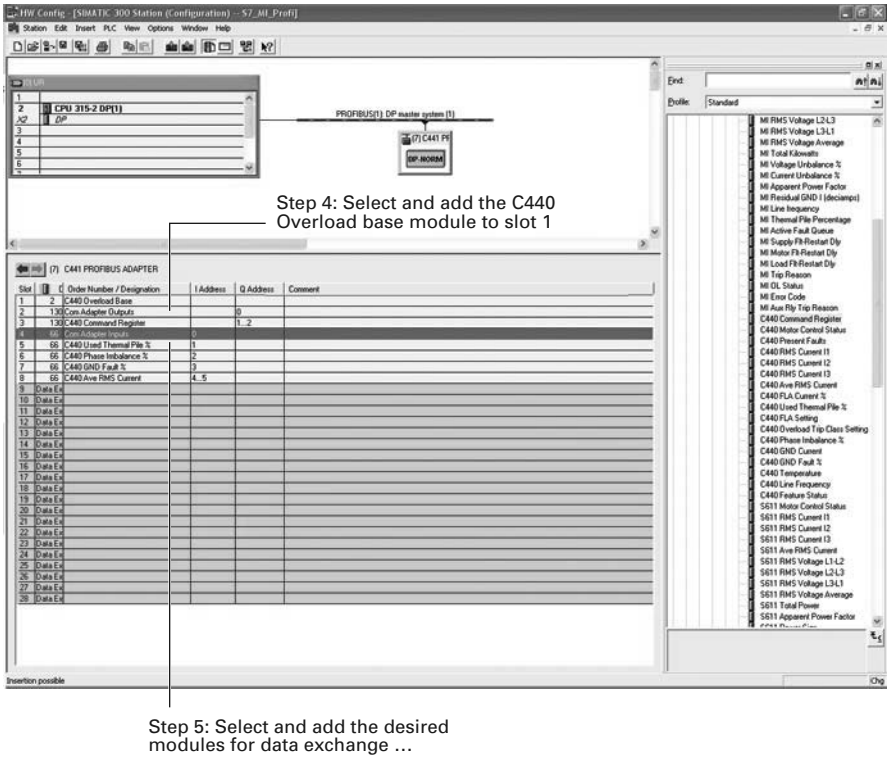
4. Select and add the C440 overload base module to slot 1 of the C441Q/S PROFIBUS communication module configuration.

   Note: The C440 Overload Base Module MUST be placed in slot 1 of the configuration. Failure to do so will cause configuration to fail.

C440 Overload Base Module



5. Select and add the desired modules for data exchange in slots 2 to 28. Select only those modules supported by the base module. (See **Page 14** for a list of supported modules.)

   Example Configuration:

I/O Module	Type	Description
C440 Overload Base	Base–no I/O	Attached device
Communication Adapter Outputs	Output–1 byte	Controls C441 adapter outputs
C440 Command Register	Output–2 bytes	Trip/Reset C440 overload
Com Adapter Inputs	Input–1 byte	Status of C441 adapter inputs
C440 Used Thermal Pile %	Input–1 byte	Present thermal capacity
C440 Phase Imbalance %	Input–1 byte	Percent of phase imbalance
C440 GND Fault %	Input–1 byte	Percent of GND fault current
C440 Ave RMS Current	Input–2 bytes	Average of the three-phase current

   Note: Data Exchange modules can be placed in any order in slots 2 to 28.

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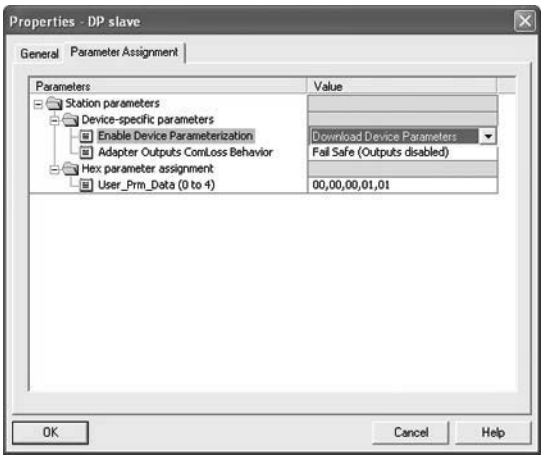
Configure C441Q/S PROFIBUS Communication Module Device Parameters

1. Select the C441 PROFIBUS Adapter to display its device parameters.
2. Set the "Enable Device Parameters and Adapter Outputs ComLoss Behavior" parameters.

   Note: To enable the parameterization of the attached device–Set "Enable Device Parameterization" to "Download Device Parameters."

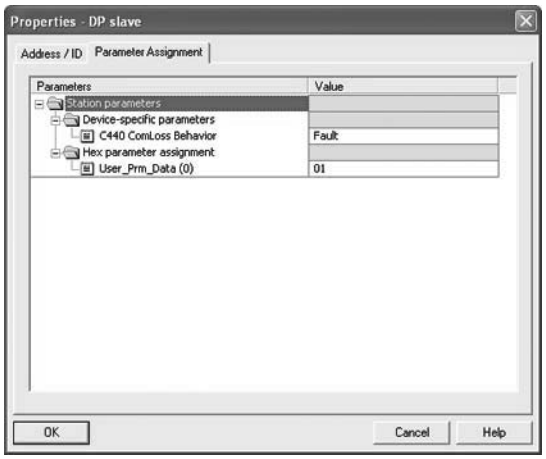
C441 PROFIBUS Communication Module Device Parameters



Configure the C440 Overload Device Parameters

Select the C440 Overload Base module to display its device parameters.

C440 Overload Device Parameters



At a minimum, the following parameters should be set according to the applications needs.

C441 PROFIBUS Adapter Parameters

- Enable Device Parameterization (must be set to Download Device Parameters)
- Adapter Outputs Communication Loss Behavior

C440 Overload Parameters

- C440 Communication Loss Behavior
  - After all configuration is complete, save and download the new configuration settings to the Master (PLC)
  - If everything is okay the C441 PROFIBUS adapter should automatically go into Data Exchange when the Master is brought online

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Operation

PROFIBUS Address

The PROFIBUS address is set using the DIP switches located on the top of the C441 communication adapter. The address can only be set through setting the hardware DIP switches. The address is in binary with the major units numbered to the right of the switch on the label. Adding up the major units set to ON will provide the address of the adapter on the PROFIBUS network.

Notice

The address specified in the switches is only set by the adapter at the time the adapter is powered on or power cycle reset. Changing these switches during operation will have no affect until the next power cycle or reset.

Notice

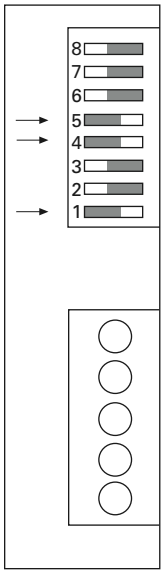
A PROFIBUS address setting of 0 will result in the C441 PROFIBUS communication module using the default Station Address of 125.

Any PROFIBUS Station Address setting greater than 125 will result in the C441 PROFIBUS communication module using the default Station Address of 125.

PROFIBUS DIP Switch Settings

DIP Switch	Value
7	64
6	32
5	16
4	8
3	4
2	2
1	1

MAC ID



Example: To set a MAC ID of 25, DIP switches 5, 4, and 1 need to be turned on, with all others off.

PROFIBUS Status LEDs

There are three LED indicators (ON, BF, and SF) to clarify the working state of the PROFIBUS module/network.

PROFIBUS Status LEDs

ON (GREEN) Left	BF (RED) Middle	SF (RED) Right	Fault condition
ON	OFF	OFF	Everything okay
ON	ON	OFF	No communication
ON	Blinking	OFF	Communication, but not in data exchange
ON	ON	ON	Configuration not okay

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Inputs

Each terminal of the field connection accepts two wires of the following size:

Field Terminal Wire Capability

Wire Type	Wire Size	Terminal Torque
Solid Cu–75°C	#14–#22	4.5 in-lbs
Stranded Cu–75°C	#16–#22	4.5 in-lbs

120 Vac Inputs

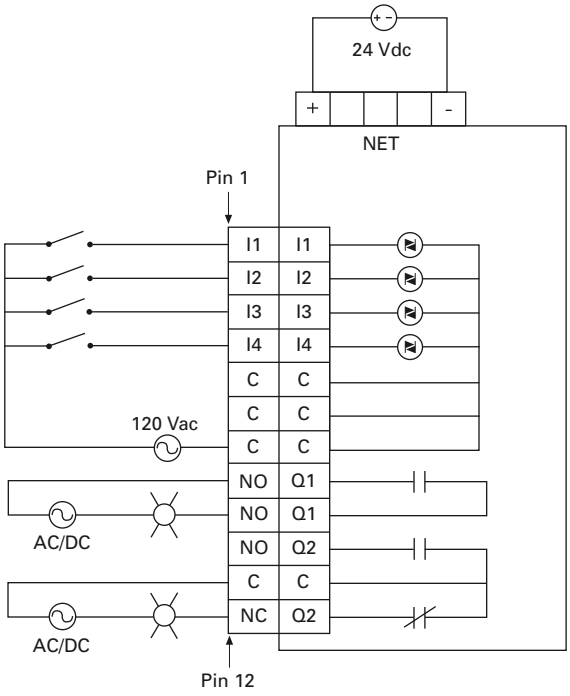
The 120 Vac input is an isolated input. It requires an external AC supply to drive the inputs.

There are three common tie points provided for the four inputs.

120 Vac Input Specifications

Specification	Value
Number of inputs	4
Nominal voltage	120 Vac
Nominal current	15 mA
Operating range	80–140 Vac
Operating frequency	50/60 Hz
Signal maximum delay	30 ms
Input type	IEC 61131-2, Type 1 digital

Example: 120 Vac Wiring Diagram



Example: 120 Vac I/O module—
All inputs are isolated.
All common terminals are connected together internally.

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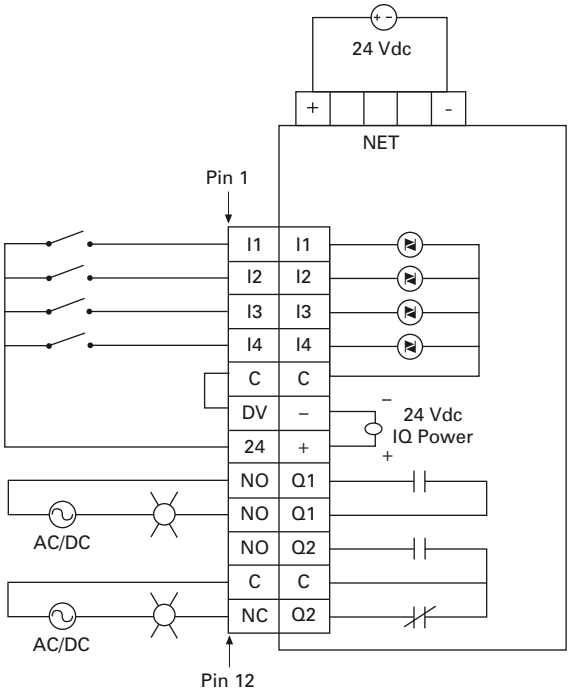
24 Vdc Inputs

The 24 Vdc input circuit is capable of both isolated and unisolated behavior. The isolated inputs share a single common tie point. A 24 Vdc current limited source/ground is provided in situations that require locally supplied input signal voltage. To use the unisolated inputs, tie the 24 Vdc ground/ common to the isolated common.

24 Vdc Input Specifications

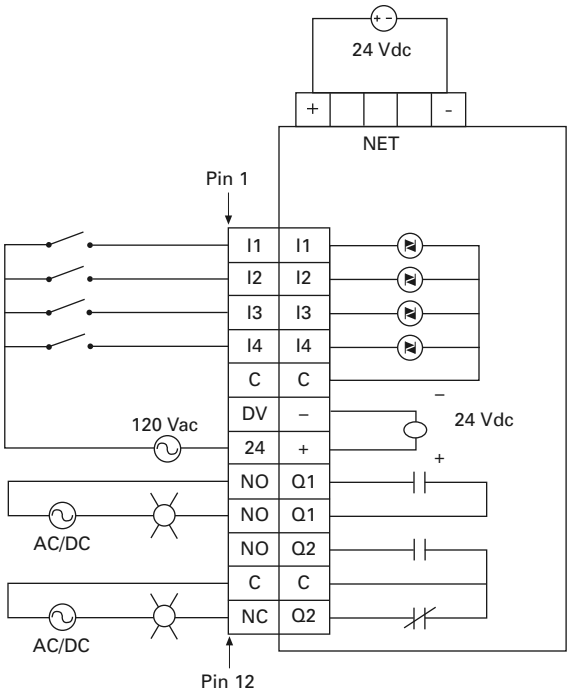
Specification	Value
Number of inputs	4
Nominal voltage	24 Vdc
Nominal current	5 mA
Type	Current sinking
Input type	IEC 61131-2, Type 1 digital
Max 24 Vdc source current	50 mA
Isolation voltage	250 Vac

24 Vdc Wiring Diagram (Non-isolated)



Example: Non-isolated 24 Vdc input source—
Input source power is taken from the 5-pin connector.
Connect C and 0V together.
Use 24 to source inputs.

24 Vdc Wiring Diagram (Isolated)



Example: Isolated 24 Vdc input source—
The inputs must be supplied by an external power source.
Do not connect the external supply to terminals 0V and 24.
Connect isolated power source between C and inputs.

Note: Do not connect a 24 Vdc source to pins 6 and 7. The "I/O Power: 24 Vdc" is to be used only in conjunction with the inputs. It is a 24 Vdc output intended to only supply signal power for the inputs. When using the 24 Vdc input supply, pin 6 should only be connected to pin 5 (24 Vdc input supply common to input common). See example wiring diagram on **Page 16**. Any device using the provided 24 Vdc input supply must have 500V isolation from ground. Example devices include pushbuttons and auxiliary contacts.

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Relay Output Behavior

Two relay outputs are provided, one Form A (NO) and one Form C (NO, NC). See **Pages 15–17** for wiring diagrams.

Relay Specifications

Specification	Value
Number of contacts	2 independent relays (1 Form C, 1 Form A)
Thermal contact	5A
Rated insulated voltage	300 Vac
Maximum operating voltage	120 Vac
Electrical life	1 x 10^5 operations
Mechanical life	1 x 10^5 operations

Parameterization

The C441Q/S PROFIBUS communication modules give the user the ability to enable/disable protections, setup trip thresholds, setup trip delays, and reset delays for the various attached base devices over a PROFIBUS network.

Upon reception of the Parameterization telegram, device parameter data is range checked. If the data is outside the range specified in the GSD file the parameterization will be rejected and parameterization will fail.

Note: Values must fall within the range specified in the GSD file for parameterization to be successful.

Notice

The "Enable Device Parameterization" parameter must be enabled for the attached device's parameters to be downloaded. If the "Enable Device Parameterization" parameter is set to "Ignore" (0), device parameters are "ignored" by the C441 PROFIBUS communication module and are not downloaded into the attached device.

The parameters available for setup through the device parameters and parameterization message are as follows:

C440 Overload Device Parameters Available During Parameterization

Extended User Parameter Data

Parameter Name	Location	Notes
Enable Device Parameterization	Adapter	**0** = Ignore user data
		1 = Download device parameters
Com Adapter Outputs ComLoss Behavior	Adapter	**0** = Fail safe (outputs disabled)
		1 = Hold last state
C440 Communication Loss Behavior	C440	**0** = Fault
		1 = Hold last state

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Configuration

The C441Q/S PROFIBUS communication modules are modular devices, in that, different data exchange modules can be added and/or removed from the configuration based on customer needs. The C441Q/S PROFIBUS communication module supports up 28 slots/modules. 1 base module slot and 27 additional slots for data exchange modules. Slot 1 is reserved for the "base module" and data exchange modules can be loaded into slots 2 to 28.

Notice

The attached base module must appear in slot 1 of the configuration. If the base module appears in any other slot and/or the incorrect base module is selected, the configuration will fail.

C440 Overload Supported Configuration Modules

I/O	Size (in bytes)	Configuration Modules	Notes
N/A	0	C440 Overload Base ①	Base module for C440 overload
Output	1	Com Adapter Outputs	**0x01** = Turn on relay 1
			0x02 = Turn on relay 2
Input	1	Com Adapter Inputs	**0x01** = I0 enabled
			0x02 = I1 enabled
			0x04 = I2 enabled
			0x08 = I3 enabled
Input	1	Com Adapter Status	**0x0001** = Adapter connected
			0x0002 = Message error
			0x0004 = Adapter married
			0x0008 = Adapter marriage not complete
Output	2	C440 Command Register ②	**0x0001** = Trip C440
			0x0002 = Reset C440
Input	1	C440 Motor Control Status	**0** = Stopped
			1 = Running
			2 = Tripped
Input	2	C440 Present Faults	**Bit Feature**
			0 = Overload Fault
			1 = Phase Imbalance
			2 = Phase Loss Fault
			3 = Ground Fault
			4 = Network Trip Command
			5 = NV Memory Failure
			6 = Reserved

Notes

① Base module must be loaded into slot 1 of the configuration. This MUST be the first module listed in the configuration.

② Command register will clear after write.

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C440 Overload Supported Configuration Modules, continued

I/O	Size (in bytes)	Configuration Modules	Notes
Input	2	C440 RMS Current I1	Scaling: value in 0.01 amps
Input	2	C440 RMS Current I2	Scaling: value in 0.01 amps
Input	2	C440 RMS Current I3	Scaling: value in 0.01 amps
Input	2	C440 RMS Current Ave	Scaling: value in 0.01 amps
Input	1	C440 FLA Current %	Presents the average current as a percent of the FLA setting
Input	1	C440 Used Thermal Pile %	Present thermal capacity (100% equates to a trip condition)
Input	2	C440 FLA Setting	The present FLA setting (the potentiometer selects this value)
Input	1	C440 Overload Trip class	The present FLA trip class
Input	1	C440 Phase Imbalance %	Percent of measured phase imbalance
Input	2	C440 GND Fault Current	Scaling: value in 0.01 amps
Input	1	C440 GND Fault %	Percent of ground fault measured: GF% = GFC/([0.5]*FLA)
Input	2	C440 Temperature	The temperature as seen by the microcontroller (accuracy ~ 10%)
Input	2	C440 Line Frequency	The line frequency measured by the device (the frequency is displayed in deciHz)
Input	2	C440 Feature Status	**Bit Feature**
			01 = Class Index
			00 = Class 10a
			01 = Class 10
			10 = Class 20
			11 = Class 30
			2 = Phase loss/imbalance enabled
			3 = Ground fault enabled
			4 = Auto reset enabled
			5 = Remote reset active
			8 = DIP switch position 0
			9 = DIP switch position 1
			10 = DIP switch position 2
			11 = DIP switch position 3
			12–15 = Reserved

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Diagnostics

The C441Q/S PROFIBUS communication modules use extended diagnostics to provide the user with status information along with fault and warning data relevant to the operation of the attached C440 overload.

Any time a fault condition is present in the attached C440 overload or the communication module itself, the "ext. diag." bit (bit3 in first diagnostic data byte) will be set high, indicating to the Master, a high level diagnostic message and fault is present. The C441 PROFIBUS communication module will also set the appropriate bit/bits in diagnostic data bytes 15 and 16 to indicate to the user the reason for the fault condition.

When the fault condition is cleared the "ext. diag." bit (bit3 in first diagnostic data byte) will also clear indicating to the Master that the C441 PROFIBUS communication module and C440 overload are ready for operation.

Notice

The ext.diag. bit will remain set as long as there is a fault condition present in the C441 PROFIBUS adapter or in the attached C440 overload.

Notice

The user should monitor extended user diagnostic byte 8 bit0–Adapter Connected/Unconnected to determine when data presented during data exchange becomes valid.

C441 Diagnostic Telegram

Byte	Bit	Description	Ext Diag Bit
1	0	Diag.station: Station does not exist (set by Master)	Default Diagnostic Data
	1	Diag.station_not_ready: Station is not ready for data exchange	
	2	Diag.cfg_fault: Configuration data does not agree	
	3	ext.Diag: Slave has high priority extended diagnostic data	
	4	Diag.not_supported: Requested function is not supported	
	5	Diag.invalid_slave_response: Sets slave to 0, fixed	
	6	Dig.prm_fault: incorrect parameterization	
	7	Diag.master_lock: Slave is parameterized by different master	
2	0	Diag.prm_req: Slave has to be re-parameterized	Default Diagnostic Data
	1	Diag.stat_diag: Static diagnosis	
	2	Fixed at 1	
	3	Diag.WD_on: Threshold monitoring activated	
	4	Diag.freeze_mode: Freeze command received	
	5	Diag.sync_mode: Sync command received	
	6	Reserved	
	7	Diad.deactivateed (sets master)	
3	0-6	Reserved	Default Diagnostic Data
	7	Diag.ext_overflow	
4	—	Master address after parameterization (FF before parameterization)	Default Diagnostic Data
5	—	Ident number (MSB)	Default Diagnostic Data
6	—	Ident number (LSB)	Default Diagnostic Data

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C441 Diagnostic Telegram, continued

Byte	Bit	Description		Ext Diag Bit
7	—	Header byte – Device Data		Extended Diagnostic Data
	0	Length of User Ext Diagnostic Data		
	1	Length of User Ext Diagnostic Data		
	2	Length of User Ext Diagnostic Data		
	3	Length of User Ext Diagnostic Data		
	4	Length of User Ext Diagnostic Data		
	5	Length of User Ext Diagnostic Data		
	6	**0** = Device Data		
	7	**0** = Device Data		
8	0	**1** = Adapter Connected	S/F	Extended Diagnostic Data
	—	**0** = Adapter Not Connected		
	1	Reserved		
	2	**1** = Adapter Married	S/S	
	3	Reserved		
	4	Reserved		
	5	Reserved		
	6	Reserved		
	7	Reserved		
9	8-15	Reserved		Extended Diagnostic Data
10	16-23	Reserved		Extended Diagnostic Data
11	24-31	Reserved		Extended Diagnostic Data
12	32-39	Reserved		Extended Diagnostic Data
13	40-47	Reserved		Extended Diagnostic Data
14	48-55	Reserved		Extended Diagnostic Data
15	56	**1** = C440 Overload Running	S/S	Extended Diagnostic Data
	57-63	Reserved		
16	64	**1** = C440 Overload Trip	F/S	Extended Diagnostic Data
	65	**1** = C440 Phase Imbalance Trip	F/S	
	66	**1** = C440 Phase Loss Trip	F/S	
	67	**1** = C440 GND Current Trip	F/S	
	68	**1** = C440 Network Trip	F/S	
	69	**1** = C440 NVRAM Memory Fault	F/S	
	70-71	Reserved		
17	72-79	Reserved		Extended Diagnostic Data
18	80-87	Reserved		Extended Diagnostic Data
19	88-95	Reserved		Extended Diagnostic Data
20	96-103	Reserved		Extended Diagnostic Data
21	104-111	Reserved		Extended Diagnostic Data

Ext Diag Bit Key

Code	Bit Sets/Clears
F/S	Ext diag bit set/ext diag bit clears
S/S	Ext diag bit clear/ext diag bit clear

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Optional Features

Freeze Mode

Freeze Mode is supported in the C441 PROFIBUS communication module.

Sync Mode

Sync Mode is supported in the C441 PROFIBUS communication module.

Fail Safe Mode

Fail Safe Mode is supported in the C441 PROFIBUS communication module. On the reception of a Clear Data frame from the Master, the C441 PROFIBUS communication module outputs will go to fail safe mode–outputs disabled.

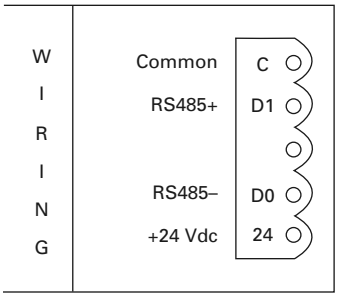
Remote Modbus Port

The C441Q/S also incorporates a RS485 Modbus port. This port can be used for monitoring purposes. All registers listed in section 7.13–Modbus Register Map are accessible through this port. See below for Modbus connections.

RS485 Modbus

Pin No.	Circuit	Description
1	Common	24 Vdc common input connection
2	D1	Transceiver terminal 1, V1 Voltage, Data + (V1 >V0 for binary 1 [OFF] state)
		Connection for Remote Modbus Port
3	—	NC
4	D0	Transceiver terminal 0, V0 Voltage, Data –(V0 > V1 for binary 0 [ON] state)
		Connection for Remote Modbus Port
5	+24 Vdc	+24 Vdc supply input connection

Modbus RS485 Connections



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